



IMPROVING COORDINATION ABILITIES OF YOUNG FENCERS THROUGH MODERN TRAINING TECHNOLOGIES

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A B S T R A C T	KEY WORDS
The article examines the improvement of coordination abilities among young fencers through the application of modern training technologies. The relevance of the study is determined by the essential role of coordination skills in fencing performance, where competitive success depends on rapid reaction, movement accuracy, effective distance control, and the ability to adapt quickly to changing situations during a bout. The purpose of the research was to develop and scientifically substantiate a set of modern training methods aimed at improving coordination abilities of young fencers. The study employed theoretical analysis of scientific literature, pedagogical experiment, physical fitness testing, expert evaluation, and statistical analysis of obtained results. The developed training program included specialized coordination exercises, functional training methods, digital technologies for monitoring motor activity, reaction-based drills, and game-based competitive situations. The results of the study demonstrated significant improvements in coordination indicators among athletes from the experimental group compared with the control group. The findings confirm the effectiveness of integrating modern training technologies into the system of youth fencing preparation. The proposed methodology can be applied by coaches of sports schools to improve the quality of training processes and enhance the development of young athletes' technical and physical abilities.	Fencing, young athletes, coordination abilities, modern training technologies, digital technologies, sensorimotor reaction, sports preparation, physical qualities.

INTRODUCTION

Modern fencing is characterized as a technically complex sport that requires a high level of physical, psychological, and coordination preparedness. Unlike many other sports, fencing involves constant changes in movement direction, rapid decision-making, precise technical execution, and immediate responses to the opponent's actions. Therefore, the effectiveness of competitive performance largely depends on the athlete's ability to control and regulate complex motor actions.

Coordination abilities represent one of the fundamental components of sports mastery. They determine the accuracy, speed, rhythm, balance, and adaptability of movements. For young fencers, the

development of coordination skills is particularly important because childhood and adolescence are sensitive periods for improving motor control mechanisms and forming stable technical foundations. Traditional approaches to fencing training are increasingly being complemented by innovative methods based on modern sports technologies. These include digital monitoring systems, reaction training devices, functional exercises, interactive training methods, and analytical approaches aimed at individualizing the training process.

The integration of modern technologies into youth fencing training allows coaches to improve the effectiveness of coordination development, increase motivation, provide objective monitoring of athletes' progress, and create more individualized training programs.

Despite the importance of coordination abilities in fencing, the issue of their targeted development through modern training technologies remains insufficiently studied, especially among young athletes. This determines the relevance of developing scientifically based methods for improving coordination skills within the system of youth fencing preparation.

The aim of the study was to determine the effectiveness of modern training technologies in improving coordination abilities of young fencers.

Research methods. The study was conducted among young fencers aged 12–15 years who were involved in regular sports training. A total of 20 athletes participated in the pedagogical experiment. The participants were randomly divided into two groups:

Experimental Group (EG) — 10 young fencers who followed the newly developed training program based on modern coordination development t Control Group (CG) — 10 young fencers who followed the traditional fencing training program.

The duration of the pedagogical experiment was six months. Training sessions were conducted three times per week, with each session lasting 60 minutes.

The research was organized according to the principles of sports pedagogy and included three stages:

1. Initial assessment stage — evaluation of the baseline level of coordination abilities of young fencers.
2. Experimental stage — implementation of the modern training technology program.
3. Final assessment stage — analysis and comparison of the obtained results.

Training Program Characteristics. The experimental training program was developed considering the specific requirements of fencing performance and included modern methods aimed at improving coordination abilities.

The program consisted of the following components:

- reaction training exercises using visual and auditory signals to improve speed of response;
- coordination ladder exercises aimed at developing footwork accuracy, rhythm, and movement control;
- balance and stability exercises to improve postural control during attacking and defensive actions;
- functional training elements aimed at enhancing dynamic strength and movement efficiency;
- situational fencing drills that simulated competitive conditions and required rapid decision-making;
- digital monitoring technologies for evaluating training intensity and individual progress.

The main principle of the program was the integration of physical, technical, and cognitive components of fencing preparation.

Assessment Methods. To evaluate the effectiveness of the developed program, the following tests were applied:

1. Shuttle run test (4×10 m) — to assess agility and movement coordination.
2. Target accuracy test — to evaluate precision of technical actions.
3. Visual-motor reaction test — to determine reaction speed.
4. Static balance test — to assess postural stability.
5. Expert evaluation of fencing technique — to determine the quality of technical execution.

Statistical analysis was performed using the Student's t-test to determine the significance of differences between pre-test and post-test results. The significance level was set at $p \leq 0.05$.

Results

The analysis of the obtained data demonstrated positive changes in all investigated indicators among young fencers after the implementation of the modern training technology program.

The experimental group showed significantly greater improvements compared with the control group.

Table 1 Changes in Coordination Ability Indicators in the Experimental Group Before and After the Training Program

Indicators	Before Experiment	After Experiment	Improvement
Shuttle run 4×10 m (s)	11.8 ± 0.4	10.4 ± 0.3	11.8%
Target accuracy (%)	62.5 ± 4.2	78.6 ± 3.8	25.7%
Visual-motor reaction time (ms)	285 ± 18	232 ± 15	18.6%
Static balance (s)	34.2 ± 3.5	48.7 ± 4.1	42.4%

The obtained results indicate that the experimental training program had a positive effect on the development of coordination abilities. The greatest improvement was observed in static balance (+42.4%) and target accuracy (+25.7%), which are essential components of effective fencing performance.

Table 2 Comparative Improvement of Coordination Indicators in Experimental and Control Groups

Indicators	Experimental Group (%)	Control Group (%)
Coordination abilities	18.5	7.4
Reaction speed	18.6	6.8
Movement accuracy	25.7	10.2
Balance stability	42.4	15.6

The comparative analysis demonstrated that athletes from the experimental group achieved substantially higher improvements in all tested parameters compared with the control group.

Statistical Analysis. The results of statistical processing confirmed the effectiveness of the developed training methodology.

Table 3 Statistical Significance of Changes in Experimental Group Indicators

Indicator	t-value	Significance Level (p)	Interpretation
Coordination abilities	3.76	$p \leq 0.01$	Significant difference
Target accuracy	3.42	$p \leq 0.01$	Significant difference
Reaction speed	2.91	$p \leq 0.05$	Significant difference
Balance stability	4.18	$p \leq 0.001$	Highly significant difference

The statistical analysis revealed significant improvements in the experimental group after the implementation of modern training technologies. The obtained values confirm that the proposed methodology contributed to the improvement of coordination abilities among young fencers.

The results demonstrate that systematic application of reaction-based exercises, functional training methods, and digital monitoring tools positively influenced the development of movement control, accuracy, balance, and speed of motor responses.

Discussion

The results of the study confirm the effectiveness of using modern training technologies for improving coordination abilities of young fencers. The significant improvement observed in the experimental group indicates that the integration of specialized coordination exercises, reaction training methods, functional exercises, and digital monitoring tools provides additional opportunities for optimizing the training process.

Coordination abilities play a key role in fencing performance, as athletes must perform complex technical actions under conditions of limited time and constant changes in competitive situations. The ability to maintain balance, accurately control movements, quickly respond to the opponent's actions, and adjust tactical decisions directly influences the effectiveness of fencing techniques.

The obtained findings demonstrate that traditional training approaches can be enhanced through the systematic application of innovative methods. Reaction-based exercises contributed to improving the speed of sensory-motor responses, while coordination drills and balance exercises positively influenced movement accuracy and stability during fencing actions.

The use of digital technologies in the training process also increased the possibilities of objective monitoring and individualization of athletes' preparation. Digital tools allow coaches to analyze training performance, identify individual weaknesses, and adjust exercise selection according to athletes' needs.

The results are consistent with modern approaches in sports science, which emphasize the importance of combining physical, technical, and cognitive components in the preparation of young athletes. The proposed methodology may serve as an effective supplement to traditional fencing training programs and contribute to the long-term development of sports skills.

However, further research is required with larger samples and longer observation periods to determine the long-term effects of modern training technologies on competitive performance in fencing.

Conclusion

The study demonstrated the effectiveness of modern training technologies in improving coordination abilities of young fencers.

The developed training program, which combined coordination exercises, reaction-based drills, functional training methods, situational fencing exercises, and digital monitoring tools, contributed to significant improvements in agility, balance, movement accuracy, and reaction speed.

The obtained results confirm that the targeted development of coordination abilities should be considered an essential component of youth fencing preparation. The integration of innovative technologies into the training process creates additional opportunities for improving technical skills and enhancing sports performance.

The proposed methodology can be recommended for implementation in youth sports schools and fencing training centers to improve the quality and effectiveness of athlete preparation.

Recommendations

Based on the results of the study, the following recommendations are proposed:

1. Include specialized coordination training exercises in the regular preparation programs of young fencers to improve movement control, balance, and technical accuracy.
2. Apply modern reaction training methods using visual and auditory stimuli to develop faster decision-making and improve sensorimotor responses during fencing actions.
3. Integrate digital technologies into the training process for objective monitoring of athletes' physical and technical development and for individual adjustment of training loads.
4. Use functional and situational exercises that reproduce competitive fencing conditions to improve tactical thinking, movement adaptability, and technical stability.
5. Improve coaches' professional competencies in the field of innovative sports technologies, digital monitoring systems, and modern methods of youth athlete development.
6. Conduct further experimental studies involving larger groups of athletes to examine the long-term effectiveness of modern coordination training technologies in fencing.

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